

Phase transitions and avalanches: Studying strongly correlated phenomena in cold Rydberg gases

Dr. Oliver Morsch

INO-CNR, Dipartimento di Fisica, Pisa, Italy

The strong interactions between atoms excited to Rydberg states in ultra-cold clouds make it possible to observe strongly correlated dynamical phenomena in such systems. In my talk I will present recent results on experiments with resonantly and off-resonantly excited cold rubidium gases in which we observed dynamically constrained and facilitated, avalanche-like excitation dynamics, depending on the detuning of the excitation lasers. We analyze our results using full counting statistics, which straightforwardly reveals many details of the processes involved. Finally, I will review one of our recent experiments in which we observed signatures of a dynamical phase transition in the dissipative excitation regime, in which spontaneous decay of the Rydberg states becomes relevant.

SHORT CV:

1999 D.Phil in Oxford (UK); 1999-2002 E.U. Research Fellow, Dipartimento di Fisica, Pisa (Italy);

2000-2002 Marie-Curie-Fellowship;

since 2003 Primo Ricercatore (Associate Professor) at INO-CNR (Istituto Nazionale di Ottica of the National Research Council), formerly INFN, and Lecturer at the Dipartimento di Fisica, Pisa.